Copyright IDS

Installation and User Manual

PV Smart String Box active (with contactors)
SSB-A-14-140, SSB-A-25-250

Version 2.02

Copyright IDS

Datasheet SOLO Smart String Box

Type	SSB-A-14-140	SSB-A-25-250

Electrical Data

Maximum operating voltage	U_{DC}	1000 V_{DC}	
Maximum output current DC	I_{DCmax}	140 A	250 A
Maximum number PV entrances (strings)		14	25
Maximal input current DC per string	I_{STRmax}	10 A	
String current measurement range	I_{STR}	0.5 – 15 A	
Reverse string current measuring	$I_{STR\ rev}$	Yes	
Surge arrester		Type II	
State indication lamp on the door		Yes	
Test voltage		2.5 kV, 50 Hz, 1 min	
Surge arrester fault indication		Yes (auxiliary dry contacts)	

Mechanical Data

Dimensions in mm	W x D x H	700 x 270 x 500	
Weight	m	26 kg	29 kg
Colour		RAL 7035 (light grey)	
Enclosure material		Glass-fibre-reinforced and halogenfree polyester	
Protection class according to EN 60529		IP55 (outdoor)	
Impact strength according to EN 50102		IK10	
Max air humidity		95 %	
Ambient temperature range	T_{amb}	-20 °C ... +60 °C	
UV proof		Yes	
PV(+) Connections outer diameter Fastening torque nominal / maximal Strand wire cross-section		4.5 - 10 mm (cable gland) 1.5 Nm / 1.8 Nm 0.5 - 10 mm^2	
PV(-) Connections outer diameter Spring terminals through type (strand wire cross-section)		4.5 - 10 mm (cable gland) 0.5 - 10 mm^2	
Inverter connections outer diameter Fastening torque nominal / maximal Cable lug size		22 - 32 mm (cable gland) 25 Nm M12	
Grounding connection outer diameter Fastening torque nominal / maximal Cable lug size		7 - 13 mm (cable gland) 25 Nm M12	

String Box Interface

DC contactor control input	230 V_{AC} +10%/-15%, 50 Hz ± 10 %, P_{max} = 30W
Cable outer diameter Spring terminals through type (strand wire cross-section) Signal cable	4.5mm – 10mm (cable gland) 0.25 – 4 mm^2 3 x 1.5 mm^2 LNPE

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Datasheet SOLO Smart String Box

String Box Monitor Interface

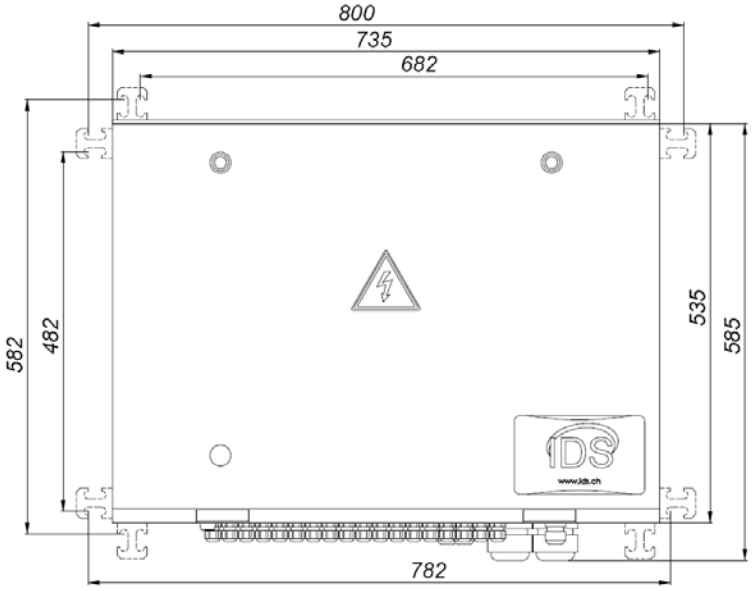
Ready feedback	Separate feedback for each Smart String Box; Closed dry contact when ready
Ready feedback output	24 $V_{AC/DC}$ (18 – 36 V), 2 A at 30 V_{DC}
Cable outer diameter Spring terminals through type (strand wire cross-section) Cable cross section	4.5 – 10 mm (cable gland) 0.25 – 4 mm^2 2 x 1 mm^2
Fibre optical interface (standard)	Ring type serial interface connection
Cable type for optical interface	Outdoor, UV light resistant, armoured Fibre type: Multimode 62,5/125 or 50/125; Cable end port ST type Recommended: A-VQ(BN)H 1x4, Corning Cable Systems
Terminals for glass fibre Cable outer diameter	ST port transmitter and receiver 4.5 – 10 mm (cable gland)
RS 485 serial interface (optional)	Separable screw terminal with. 6 pins for easy bus wiring. Galvanically isolated from monitoring electronic.
Cable type for RS485 interface	Outdoor, UV light resistant Recommended: UNITRONIC® Li2YCYv(TP) 2x2x0,5 or 3x2x0,5, Lapp Kabel
Screw type separable terminals: Cable outer diameter Cable cross section	 4.5 – 10 mm (cable gland) 0.5 – 1 mm^2

Options

Stainless steel enclosure
Fuses with visual indication when tripped
PV(–) disconnect type terminals
Maximum operating voltage 1200 V_{DC}

Standards

CE conformity / EMC	Yes / EN 61000-6-2, EN 61000-6-4 / EN 50178



Subject to change, March 2011

Ordering Information

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1 Type Code for PV Smart String Box

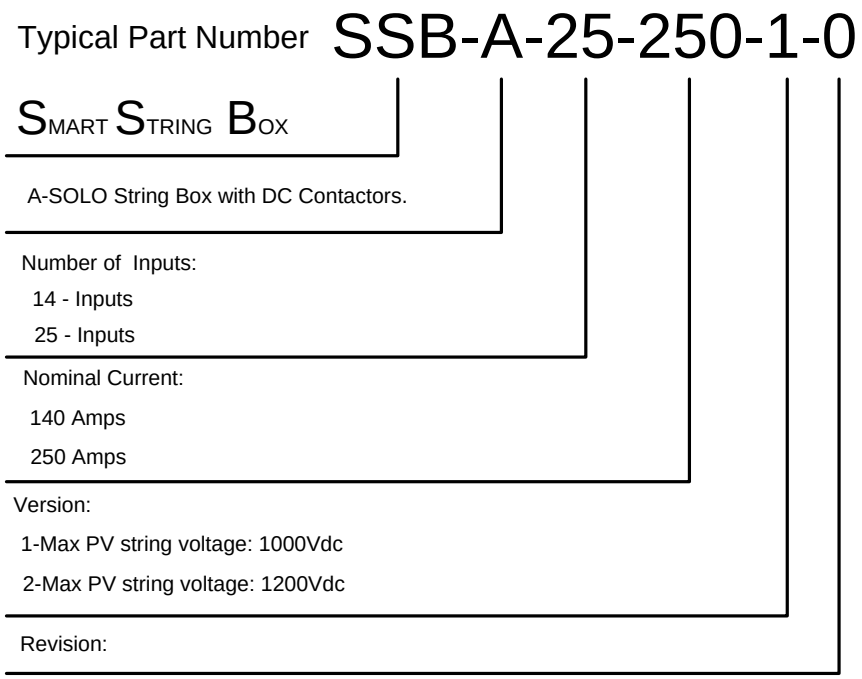

Figure 1.1 Type code for PV Smart String Box

2 Fuse Selection Guide

The fuse selection must follow the rules below:

- Maximum DC operating voltage of the fuse must be: 1.2 x nominal voltage of string
- Rated current of the fuse must be higher or equal than: 1.6 x I_{SC} at standard conditions (STC) (I_{SC} – short circuit current of panel)

Figure 2.1 Fuse selection

I_{SC}: short circuit current of panel at STC [A]	Rated current of the fuse [A]	Size [mm]	Pre-arching Joule integral [A^2s] L/R=2ms	Operating Joule integral [A^2s] L/R=2 ms	IDS article number
≤ 2 A	4 A	10x38	3.3	28	ART-07020
≤ 3 A	6 A		5.5	45	ART-07021
≤ 5 A	8 A		8	62	ART-07022
≤ 6 A	10 A		11	88	ART-07807
≤ 8 A	12 A		23	180	ART-07764
≤ 10 A	16 A		35	270	ART-07023

3 Introduction

The SOLO String Box is used to merge the electrical energy of the single PV module strings. Preferably the string box should be placed close to the PV fields. The box is also used to disconnect the DC lines from the inverter. Several SOLO String Boxes can be connected in parallel to feed one tracker input of SOLO inverter.

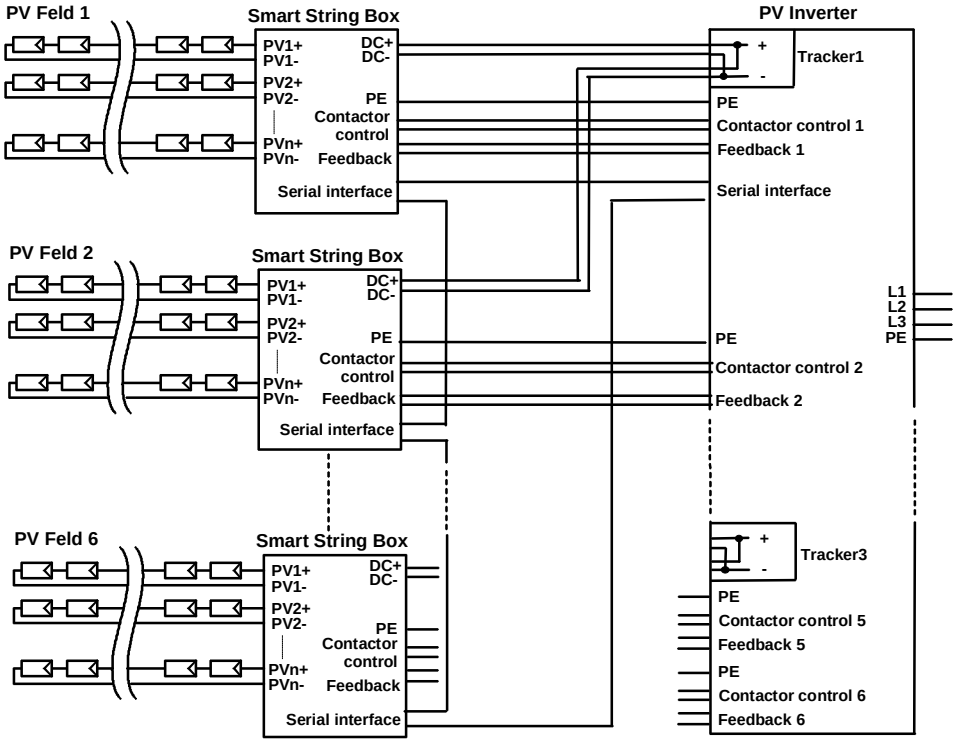

Figure 3.1 Exemplary overall scheme of a PV installation with Smart String Boxes

A different number of PV strings can be connected depending on the string box type. The positive poles of the separate power feeds are protected individually, whereas the type of the fuses must correspond to the maximum PV module string current.
The separate string currents are brought together through coupling joints and contactors toward the two DC output terminals. The currents are monitored and via serial interface (fibre optical or optional RS 485) sent to the data collector, which can be a part of the inverter or a separate module.
If an overvoltage occurs the accruing energy is discharged thorough a surge arrester.

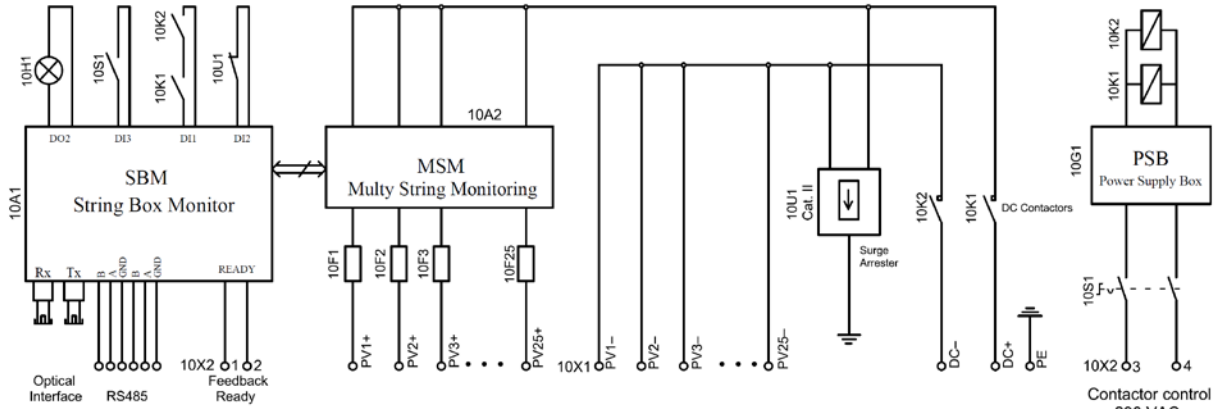

Figure 3.2 Scheme of the SOLO Smart String Box with inputs for 25 PV strings

3.1 Disclaimer

IDS delivers optimized and tested equipment like Inverters and string boxes for Solar Power Plants. The correct integration and interconnection of the equipment according to the manuals and datasheets from IDS is the responsibility of the System Integrator. IDS does not assume any liability for system design, dimensioning, build-up and the performance of the system. Claims because of downtime are excluded.

The contents of the written text are reviewed for compliance with the hardware and software described below. However, inaccuracies cannot be excluded, thus preventing us from supplying a full warranty for full compliance. The data supplied in the current manual is reviewed regularly. Corrections are included in subsequent editions.
In case of violation of the installation instructions warranty claims will not be accepted.
We discard any liability in cases of accidents and material damage, caused by inappropriate handling, undertaking of works by unauthorized personnel and the resulting damages on persons and device, as well as for any resulting subsequent damages.

3.2 General Safety Instructions

Photovoltaic installations operate with lethal voltages. The works described here should be performed only by authorized specialized personnel that are familiar with the installation, mounting, commissioning and operation of PV installation. This manual must be read and understood before the installation or the commissioning takes place.
Unauthorized personnel are not allowed to open the SOLO String Box.
The SOLO String Box may only be used for the envisaged purposes. The faultless and safe operation of the product assumes appropriate transport, specialized storage, installation and mounting as well as careful manipulation and maintenance.
The relevant regional and country-specific regulations and instructions must be obeyed. The requirements described, e.g. the placement location or the installation instructions (e.g. connection profiles, torques, etc.) must be taken under consideration at all costs.

3.3 Description of the Symbols and Warning Signs Used

	WARNING! The disobedience of this warning sign may lead to death or serious body injuries to persons.

	CAUTION! The disobedience of this warning sign could lead to property damage.

3.4 Scope of Delivery

Quantity	*Article*
1 pcs.	Smart String Box
2 pcs.	Plastic keys (one normal and one for the transport)
4 pcs.	Wall mounting kit
2 pcs.	Fuses for the strings
2 pcs.	Fuses for the Power Supply Box (PSB)
1 pcs.	Fuse for the String Box Monitor (SBM)
1 pcs.	Plug for connection of the glass fibre interface (bypass the SBM's)

3.5 Type Label

The type label with the product identification is located in the string box on the right side under the protective cover as shown in *Figure 5.4*. The label is shown in *Figure 3.3*

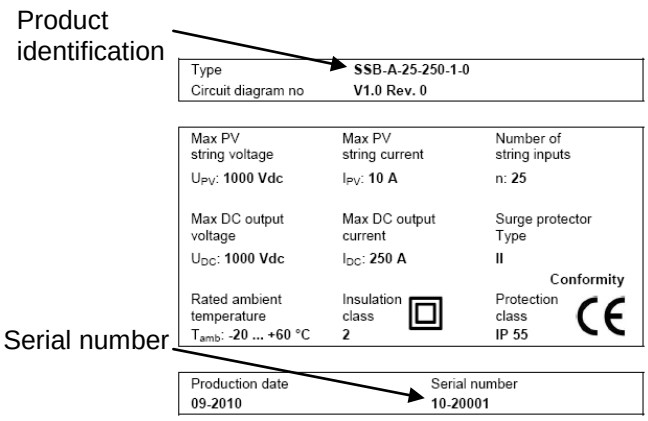

Figure 3.3 Example of a type label

4 Warnings

⚠	**WARNING!** The installation instruction must be obeyed, in particular the provisions for the installation of power current devices, for the electrical equipment of processing and manipulation machines, for the equipment of power current devices with electronic operation tools, as well as the regulations for the professional use of tools and personal protective equipment.

⚠	**WARNING!** The device must be installed, commissioned and maintained only by qualified personnel.

⚠	**WARNING!** The installation operates under life-threatening voltages. The PV module strings can be under voltage even when the SOLO String Box switch is turned off and the string protections are detached. The DC line toward the inverter can be under voltage even when the SOLO String Box switch is turned off. In addition, consider the discharge time of the inverter capacitors which is approximately 10 minutes!

⚠	**WARNING!** The SOLO String Box is a part of an entire PV installation. Therefore, please consider all warnings on the SOLO String Box and on the inverter! An automatic restart can take place after a network or photovoltaic voltage interruption.

5 Installation of the SOLO String Box

5.1 Opening the SOLO String Box Housing Door

The SOLO String Box door is closed with the use of the supplied key.

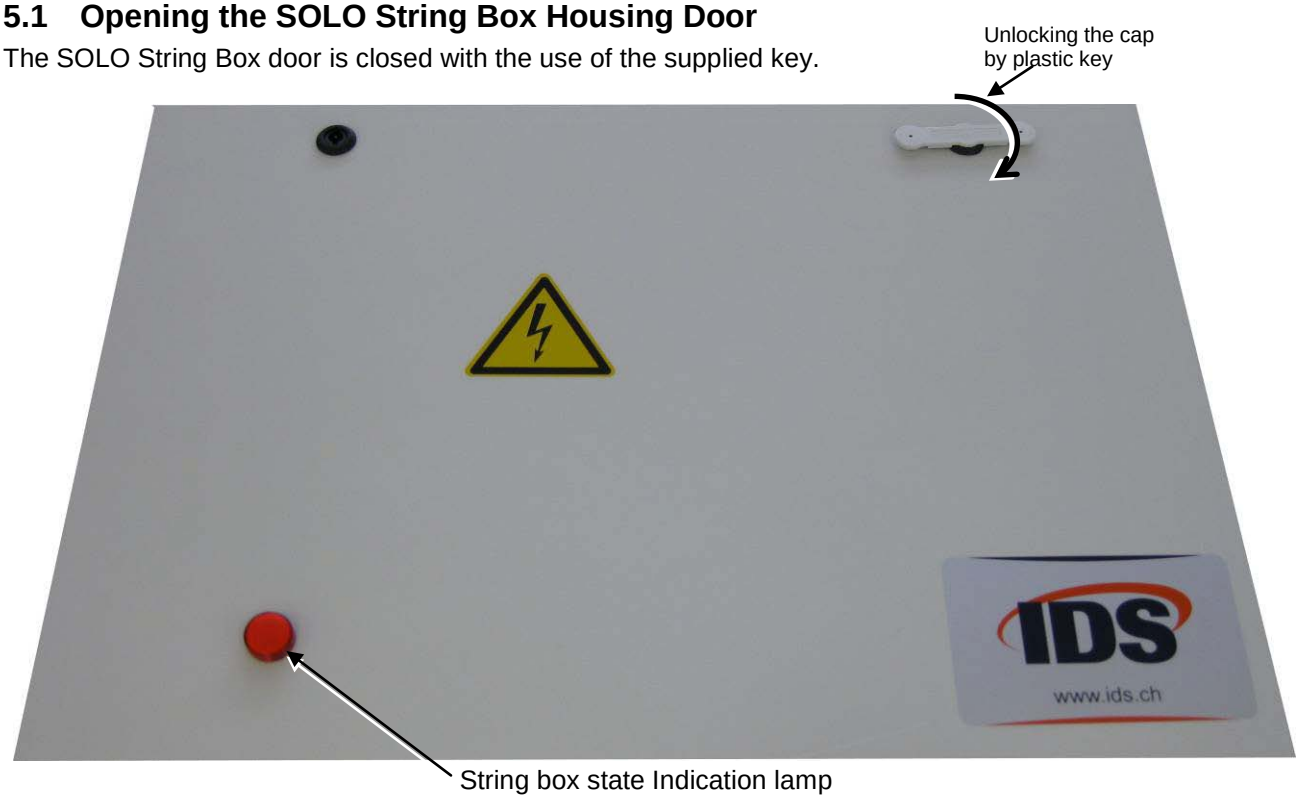

Figure 5.1 SOLO Smart String Box housing door

5.2 Opening the SOLO String Box Protective Cover

	WARNING! Even if main switch is turned off the PV side and the DC output side might be under lethal DC voltage! Removing of this protective cover shall be done by authorized and qualified personnel only! Any liability is excluded in case this rule is not respected!

The protective cover of the SOLO String Box cannot be dismounted when the main switch is “on”. In order to remove the protective cover please put the main switch in “off” position as shown on the *Figure 5.2*. Then unlock the screws by slotted screw driver (1/4 revolution) as shown on the same picture.

Figure 5.2 SOLO Smart String Box protective cover

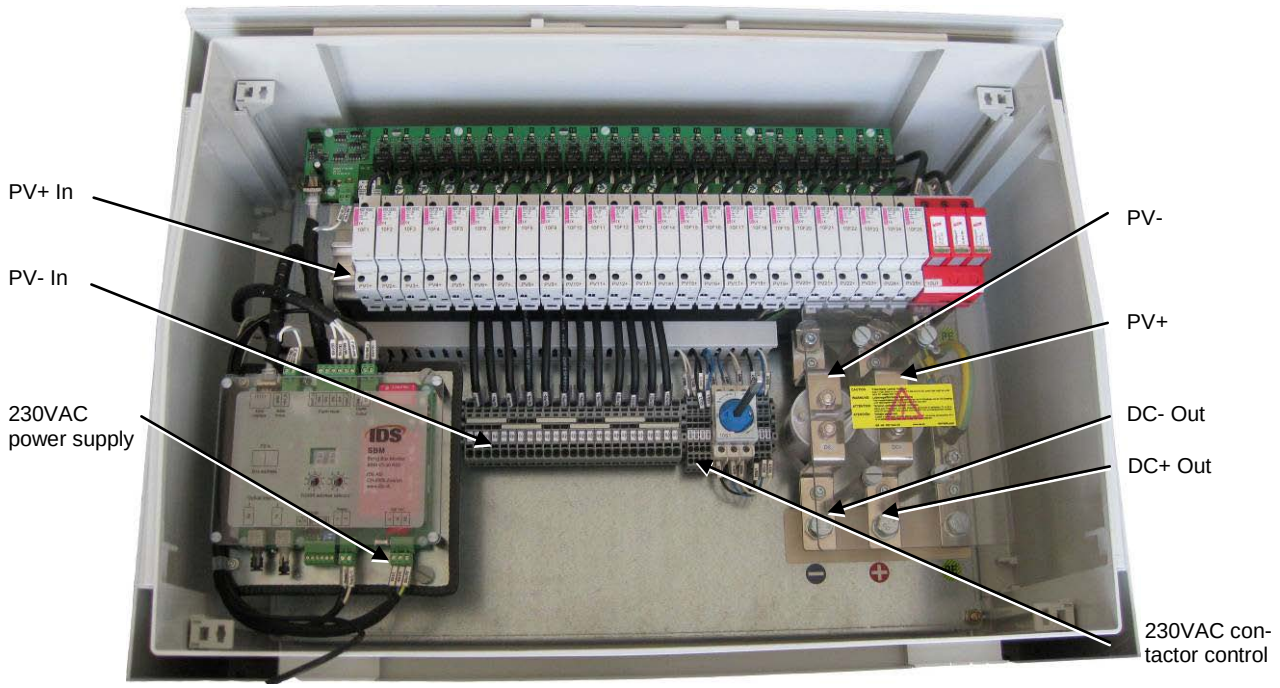

Figure 5.3 Interior view – Potentially lethal voltages location when the main switch is off

5.3 SOLO String Box Design

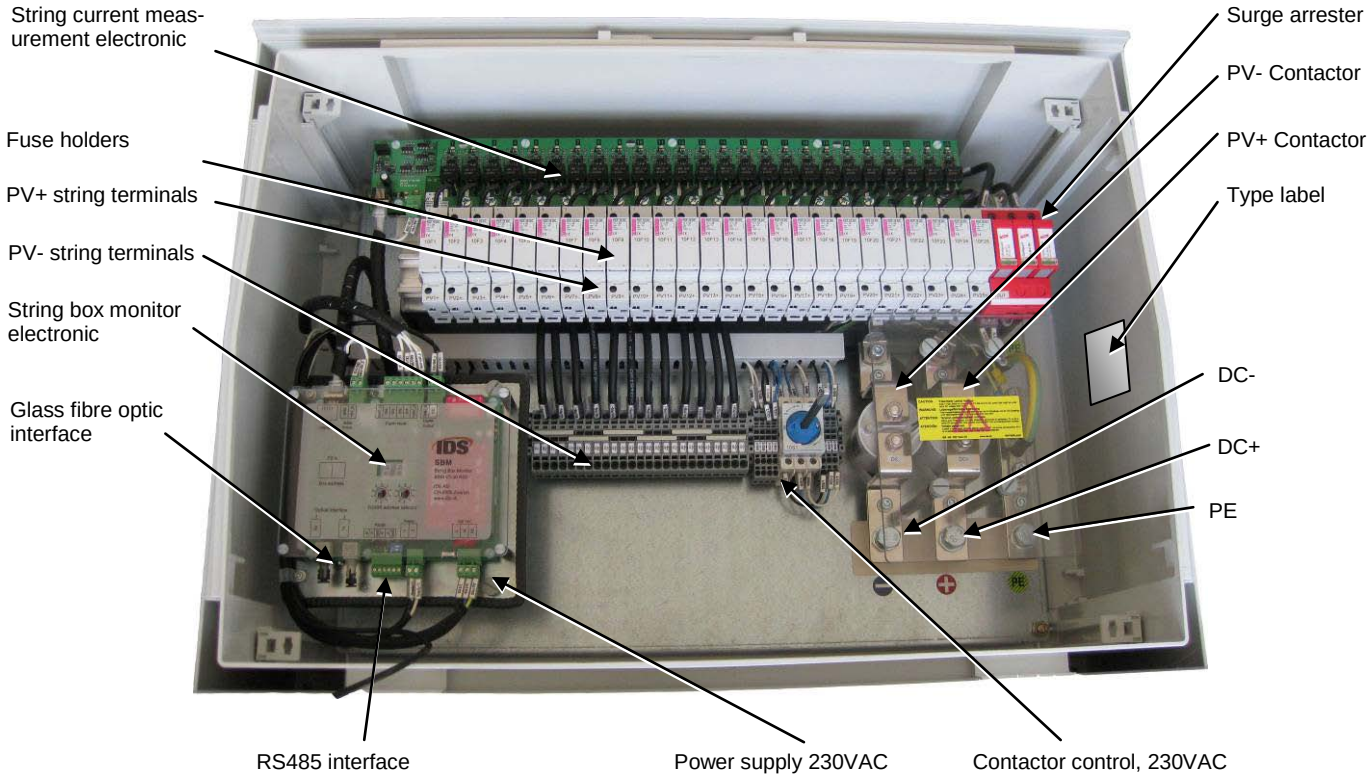

Figure 5.4 SOLO String Box (interior view)

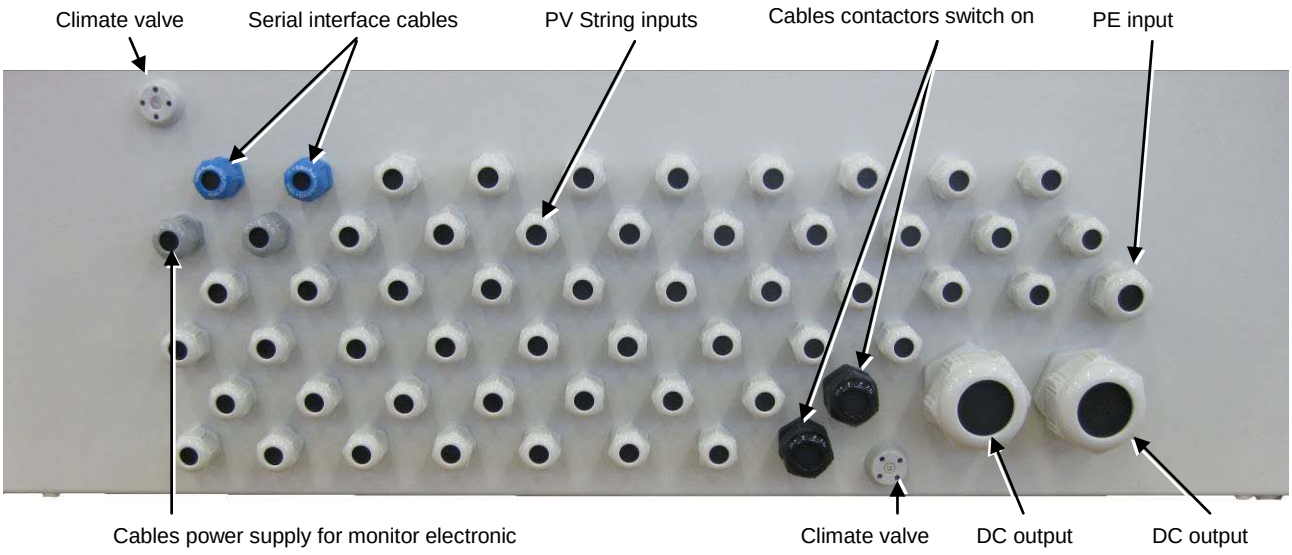

Figure 5.5 Cable glands on SOLO Smart String Box (exterior view)

Figure 5.6 Cable glands in the SOLO Smart String Box (interior view)

5.4 Location Selection

- The SOLO String Box is suitable for outdoor installation and should be placed as close as possible to the PV modules in order to minimize cable length.
- The String Box should be freely accessible for maintenance work.
- A location without direct sunlight should be chosen.
- The SOLO String Box should be mounted in a way, minimizing or preventing the collection of water, dirt and moss development.

5.5 Mechanical Installation

- The supplied fitting materials should be used where possible.
- The SOLO String Box must be mounted vertically, with the cable holdings on the bottom side.
- Water must never reach the inside of the box!

The SOLO String Box should be mounted on a wall with the help of the supplied mounting clips.

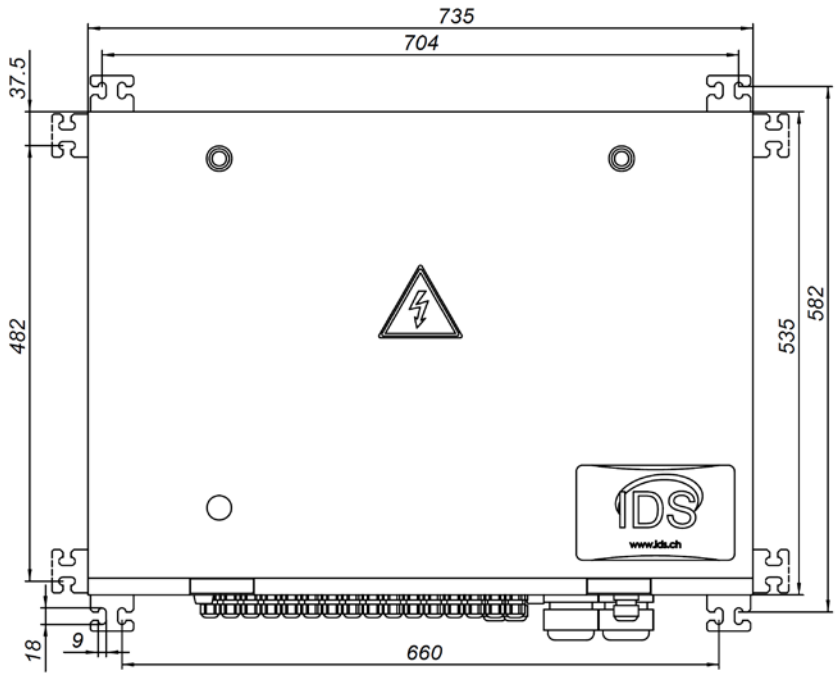

Figure 5.7 Dimension drawing SSB-A-14, SSB-A-25

The two climate valves, (see front view and rear view) must not be covered. They ensure the air circulation inside the SOLO Smart String Box.

Figure 5.8 Climate valve interior view

Figure 5.9 Climate valve exterior view

5.6 Electrical Installation

⚠	**CAUTION!** The works described may be executed only by electricians trained for PV installation.

⚠	**WARNING!** The PV module strings can be under voltage even when the SOLO String Box switch is turned off and the string protections are detached. The DC line toward the inverter can be under voltage even when the SOLO String Box switch is turned off. In addition, consider the discharge times of the inverter capacitors which is approximately 10 minutes!

⚠	**CAUTION!** The power supply lines must be mounted in a way that won't allow them to be damaged by rodents.

⚠	**CAUTION!** The electrical lines must not come in contact with flammable materials.

5.6.1 Electrical Connections of the PV Strings

⚠	**CAUTION!** Never feed a DC inlet with voltages higher than 1000V. Higher voltages lead to Box damages. In case of breach of this rule all warranties will expire and no liability for consequential damages will be undertaken.

1. Removing the fuses out of the fuse holders
2. Connect the PV string cables in the designated terminals
3. Measure the string voltage and check the polarity
4. Insert the fuses again

The correct polarity must be observed during this procedure. In case of incorrect polarity the SOLO String Box and the PV modules might be damaged! The connecting points are visible in the following pictures:

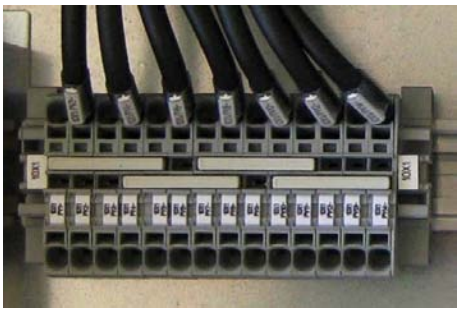

Figure 5.10 PV minus string terminals

Figure 5.11 PV minus string disconnect terminals

⚠	**WARNING!** Never break the current flow according to based on wrong poled strings by removing the fuses from the fuse holders.

The String Box Monitor inside the Smart String Box with 25 inputs (SSB-A-25) is mounted on a swivelling plate, which can be opened to install the PV+ strings cables. For this, the two plastic screws on the right side of the plate (*Figure 5.12*) have to be loosened completely. The plate with the monitoring can be swivelled to the left until it is kept magnetically (*Figure 5.13*).The PV+ terminals are now accessible.

⚠	**WARNING!** It is not allowed to open the fuse holder while current flows.

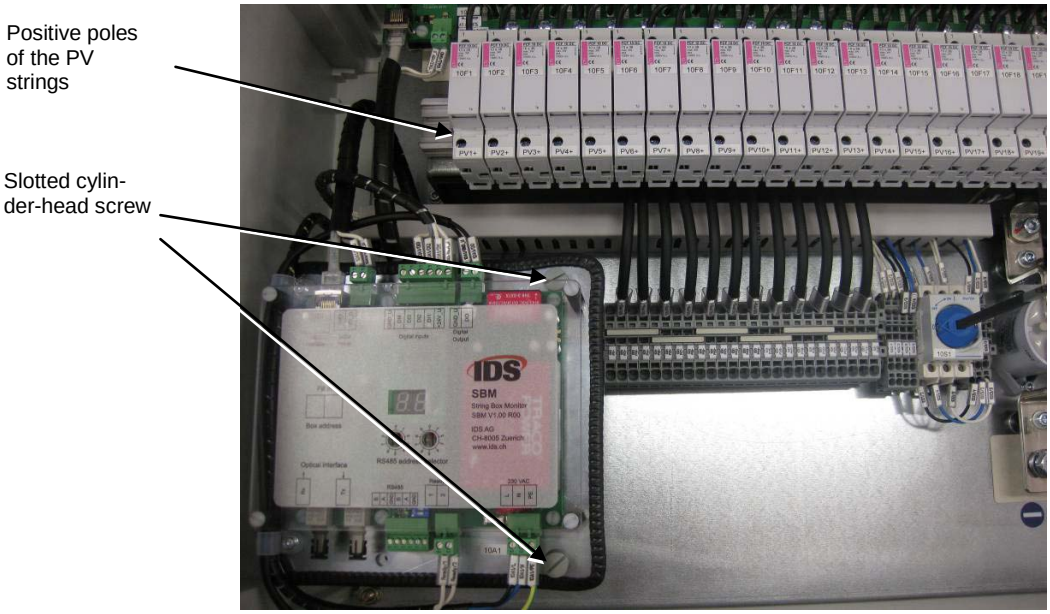

Figure 5.12 Preparation for the connection of the PV+ terminals in the SSB-A-25

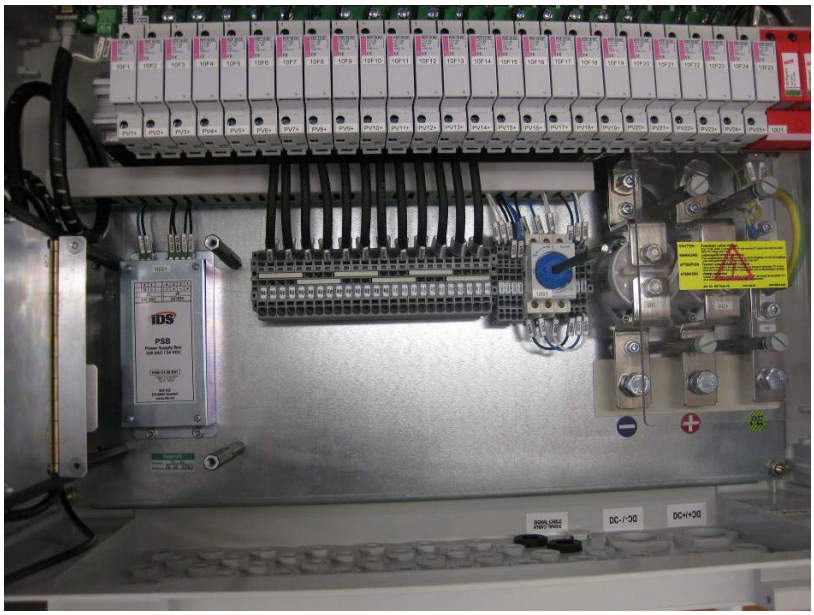

Figure 5.13 PV+ string terminals

5.6.2 Overview of the electrical connections

The following table gives a brief overview of the electrical connections and its terminal numbers. Please infer detailed information from the following sub-chapters or from the datasheet.

Table 5.1 Overview of the electrical connections		
Terminal	*Function*	*Specification*
DC +	Supply cable to inverter	Positive pole
DC -	Supply cable to inverter	Negative pole
PE	Grounding connection Smart String Box	
PV1 +… PV25 +	Connections string wires	Positive poles
10X1 PV1 - 10X1 PV25 -	Connections string wires	Negative poles
10X2/1 10X2/2	Ready feedback	24 V_{DC}
10X2/3 10X2/4	DC contactor control Supply String Box Monitor	230 V_{AC}
Rx, Tx	Connection of the fibre glass	Correspondent to the datasheet
B, A, GND	Connection serial interface RS485	Correspondent to the datasheet

5.6.3 Fuse Selection

The fuses are pre-installed at factory according to the SOLO String Box type. The fuses have to be selected according to *Chapter 2* (Fuse Type Selection).

5.6.4 Power Cable Connections from Inverter to SOLO String Box

1. For installation, the protective transparent plate must be unscrewed and detached from the box.
2. First, the grounding cable must be connected with a cable lug to the foreseen screw joint.
3. The supply cables to the inverter (*Figure 5.14*) are connected with cable lugs to the foreseen screw joints. The correct polarity must be observed!
4. The protective transparent plate must be mounted back and screwed!

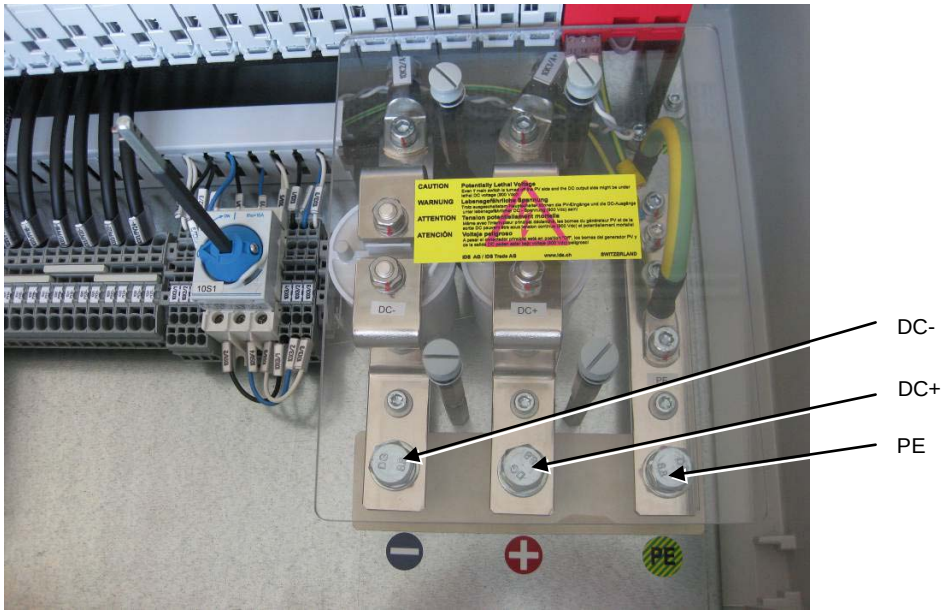

Figure 5.14 Connection of PE, DC+ and DC- output to the inverter

5.6.5 Connection of String Box Control Line and Feedback to the Inverter

The connection of DC+ and DC- terminals to PV+ and PV- string joints is done by two contactors 10K1 and 10K2 respectively. They are switched on by 230V_{AC} control line from inverter connected to control terminals 10X2/3 and 10X2/4 as shown in *Figure 5.15*.

The String Box ready feedback signal is connected to the terminals 10X2/1 and 10X2/2. The signal has to be run to the SOLO inverter. Is the String Box not ready, despite the actuation of the contactors, the SOLO inverter will report a warning. In case of a warning, the modules of the surge arresters have to be checked (green/red indicator), and if needed exchanged. If still a warning occurs, despite of intact surge arrester modules, the DC contactors have to be checked and maybe exchanged.

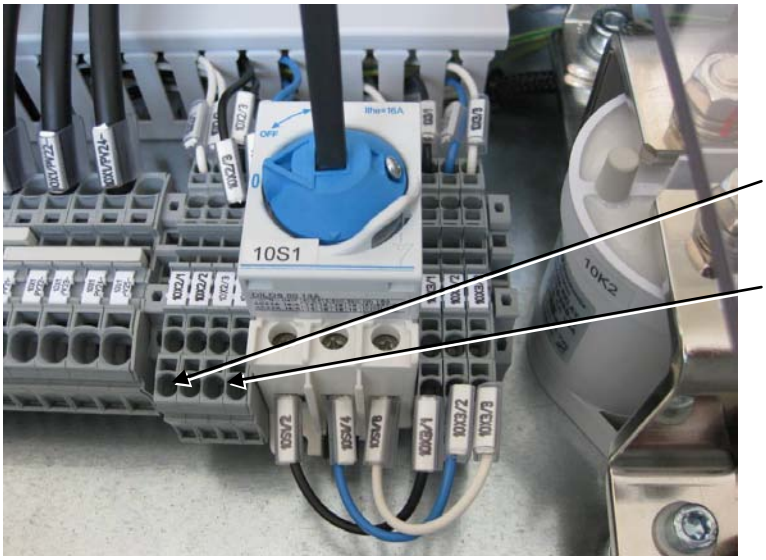

Figure 5.15 Connection terminals to signal cables

5.6.6 Connection of the Serial Interface for the String Box Monitoring

The communication for the String Box Monitoring can by realized by using the glass fibre interface (standard), or the RS485 interface (optional). The glass fibre interface requires a ring topology between the data logger in the inverter and the string boxes. Starting from the inverter the ring topology has to be connected from string box to string box with increasing address numbering.
Whereas the RS485 has to be realized as a bus and terminated in the last String Box with the termination resistance (shift the white switches to ON).

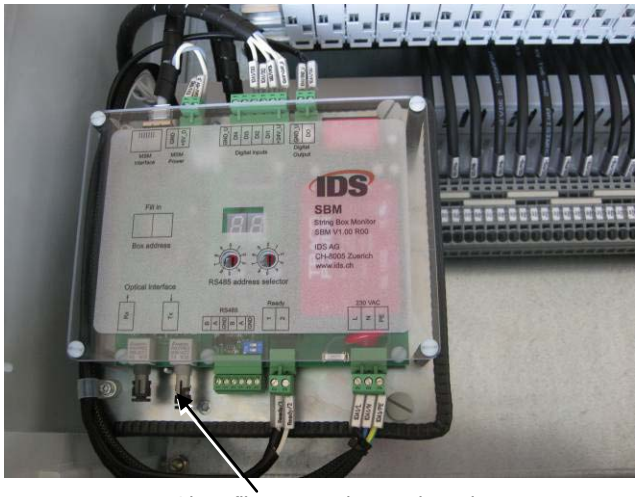

Figure 5.16 Signal cable wiring – String Box Ready connection to the inverter

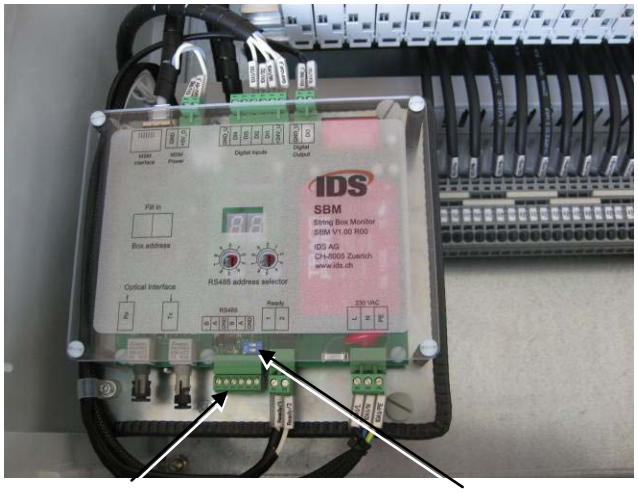

Figure 5.17 Signal cable wiring – String Box Monitor electronic power supply

6 SOLO String Box Commissioning

6.1 String Box Address Selection

All String Boxes connected to a common serial interface should have unique addresses. With the two installed address selection keys it is possible to address up to 100 string boxes in one bus. The selected address number is indicated by the help also of LED seven segment indicators, *Figure 6.1*. The two empty rectangulars on left side (label in *Figure 6.1*) are to write in with permanent marker the selected address during commisioning.

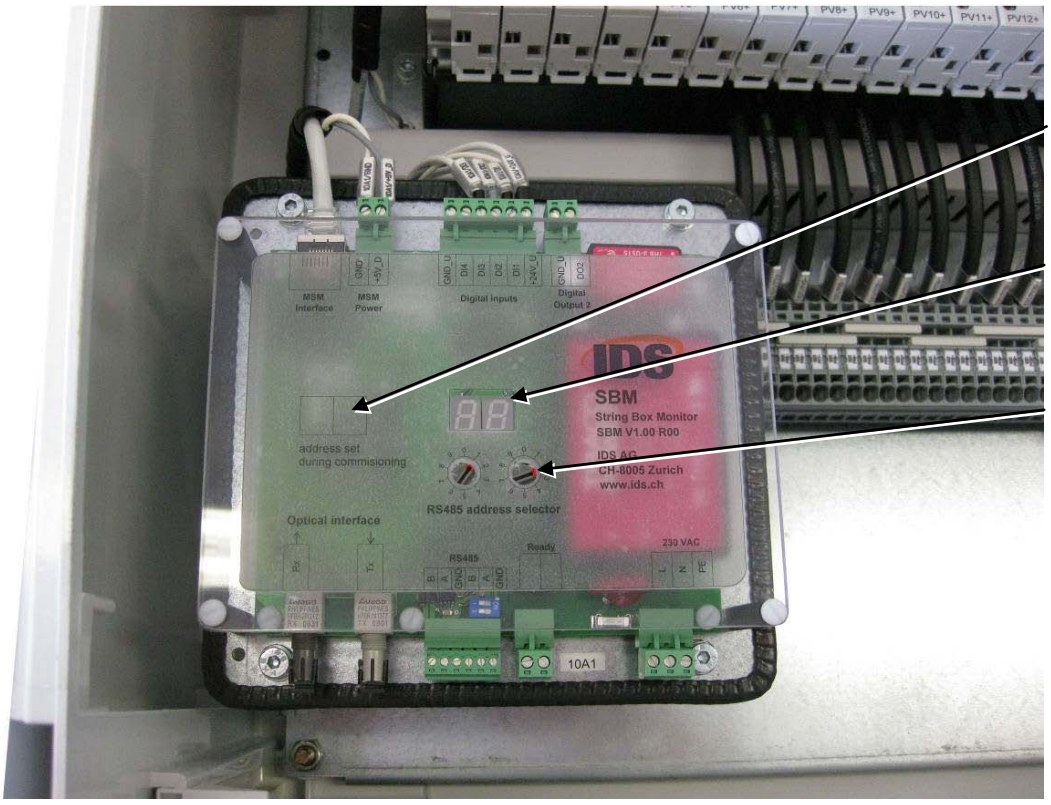

Figure 6.1 Setting the address of the String Box Monitor unit

6.2 Turning the SOLO String Box On

Make sure that the PV strings, DC+, DC-, signal and PE cables are installed correctly in the SOLO String Box. Check if the fuse links sizes are rated for the correct current. The fuse rating must comply with the rules defined in *Chapter 2* - Fuse selection guide.

⚠	**WARNING!** A wrong size of the fuse link can lead to damages both to the SOLO String Box and the PV strings.

⚠	**WARNING!** Danger of an electric shock Mount the plastic protective cover for protection against direct contact before proceeding with the commissioning.

The protective cover of the SOLO String Box can be dismounted or mounted only when the main switch is turned off (Figure 6.2).

Figure 6.2 Protective cover

The screws of the SOLO String Box protective cover can be locked with the use of a slotted screwdriver, with a quarter of a revolution clockwise.

When the PV modules in the PV installation are connected properly, the SOLO String Box is ready for operation. For the commissioning of the SOLO String Box, please observe also the instructions described in the user manual of the photovoltaic inverter.
To connect the PV modules to the photovoltaic inverter, turn the main switch to “ON” position.

Close and lock the SOLO String Box door. The indication lamp on the door should glow with red light. If the lamp is blinking this is an indication for a surge arrester or contactors or monitor electronic fault.

⚠	**CAUTION!** The door must be closed properly in order to prevent penetration of dust and humidity.

⚠	**CAUTION!** Contaminations on the rubber seal must be avoided at any cost. Damaged rubber seals must be replaced immediately.

6.3 Turning the SOLO String Box Off

In order to separate the PV modules from a photovoltaic inverter, turn the main switch in the “Off” position.

⚠	**CAUTION!** Please observe the instructions supplied in the user manual of your photovoltaic inverter.

6.4 Replacing defective Fuse Links and Surge Arresters

⚠	**CAUTION!** The works described below may be executed only by electricians trained for PV installation.

⚠	**CAUTION!** Use only original fuses. In case of use of products manufactured and offered by third parties the protection of the installation will no longer be secured.

⚠	**WARNING!** The PV module strings can be under voltage even when the SOLO String Box switch is turned off. The DC line toward the inverter can be under voltage even when the SOLO String Box switch is turned off. In addition, consider the discharge times of the inverter capacitors which is approximately 10 minutes!

6.4.1 Replacing a Fuse

⚠	**CAUTION!** Please observe the instructions supplied in the user manual of your photovoltaic inverter.

1. Check through the data logger interface which string is not producing current. This can be an indication of a damaged fuse.
2. Open the string box door.
3. Turn the main switch to “Off”.
4. Replace the fuse link by pulling out the string fuse insert.
5. Replace the fuse link with the correct rated current complying with the rules defined in *Chapter 2* - Fuse selection guide.
6. Close the string fuse insert.
7. Put the protective cover.
8. Turn the main switch on. The string is operational again.
9. Close and lock the string box door.

Figure 6.3 Open fuse link

⚠	**WARNING!** A wrong size of the fuse link can lead to damages both to the SOLO String Box and the PV strings.

6.4.2 Changing a Surge Arrester

The green indicator of the surge arrester will change its colour to red when it tripped.

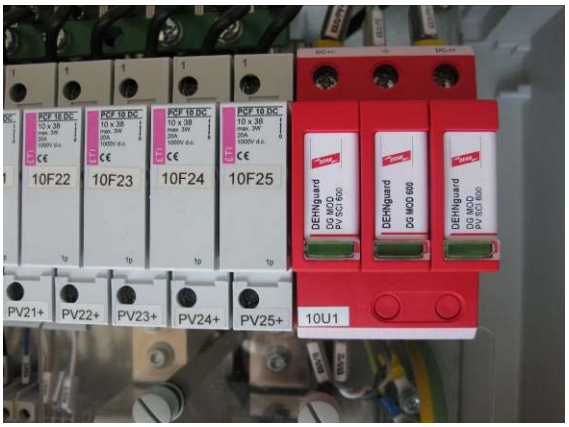

Figure 6.4 Surge arrester

The surge arrester is monitored by auxiliary potential free contacts.

⚠	**CAUTION!** The works described below must be executed only by electricians trained for PV installation.

1. Open the SOLO String Box door.
2. Turn the main switch off.
3. Unscrew and dismantle the protective cover of the SOLO String Box

⚠	**WARNING!** The PV module strings can be under voltage even when the SOLO String Box switch is turned off. The DC line toward the inverter can be under voltage even when the SOLO String Box switch is turned off. In addition, consider the discharge times of the inverter capacitors which is approximately 10 minutes!

- Remove the defective surge arrester(s) through pulling it out of the fuse holder and place a new one.

Figure 6.5 Removing of a damaged surge arrester

1. Put the protective cover.
2. Turn the main switch on.
3. Close and lock the string box door.

7 Declaration of Conformity

EG – Konformitätserklärung
EC – Declaration of Conformity

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Diese Konformitätserklärung bezieht sich auf die Anschlusskästen:
This declaration of conformity relates to string boxes:

SSB-A-14-140
SSB-A-25-250

Das bezeichnete Produkt stimmt mit den Vorschriften folgender Richtlinien überein:
The above described product is in conformity with the requirements laid down in the following guidelines:

EN 61000-6-2	Elektromagnetische Verträglichkeit (EMV) Teil 6-2: Fachgrundnormen - Störfestigkeit für Industriebereich (IEC 61000-6-2:1999, modifiziert) *Electromagnetic compatibility (EMC)* *Part 6-2: Generic standards - Immunity for industrial environments* *(IEC 61000-6-2:1999, modified)*
EN 61000-6-4	Elektromagnetische Verträglichkeit (EMV) Teil 6-4: Fachgrundnormen - Störaussendung für Industriebereiche (IEC 61000-6-4:2006) *Electromagnetic compatibility (EMC)* *Part 6-4: Generic standards - Emission standard for industrial environments* *(IEC 61000-6-4:2006)*
EN 50178	Ausrüstung von Starkstromanlagen mit elektronischen Betriebsmitteln; EN 50178:1997 *Electronic equipment for use in power installations; EN 50178:1997*

Aussteller / *issued by* M. Vinzens, CTO, IDS Trade AG

Diese Erklärung bescheinigt die Übereinstimmung mit den Richtlinien, beinhaltet jedoch keine Zusicherung von Eigenschaften.
Die Sicherheitshinweise der mitgelieferten Produktdokumentation sind zu beachten.
This declaration confirms the compliance with the quoted directive, but it does not constitute any warranty as to properties.
The safety information contained in the product documentation supplied must be adhered to.

Zürich, 21.10.2010

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M. Vinzens, IDS Trade AG

Notes

8 Contacts

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